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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 17

Application Number: 09/871,492
Filing Date: May 31, 2001
Appellant(s): CHOQUETTE ET AL.

John P. Hohimer
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed November 3, 2003.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 1-9,11-18,20, and 23 stand or fall together and but does not provide reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

5956363	Lebby et al.	9-1999
6052398	Brillouet et al.	4-2000

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lebby et al. (US 5,956,363) in view of Brillouet et al. (US 6,052,398).

Lebby et al. discloses (col. 3, line 16 – col. 4, line 45) a method of forming a vertical cavity surface emitting laser and shows (fig. 2) a vertical cavity surface emitting laser comprising a substrate (12), a first mirror (14) adjacent the substrate, an active region (20) including one or more quantum wells (35, 36), the quantum wells formed of InGaAsN (col. 4, lines 26-28), and a second mirror (26) adjacent the active region. The laser emits light at a wavelength of 1300 nm (col. 4, lines 31-34). The substrate is made of GaAs. The VCSEL comprises one or more oxide apertures (16 and 27) near the active region. The apertures include an oxidized portion comprising aluminum oxide (col. 4, lines 1-8). The VCSEL further comprises a mesa (see width d) that extends down to the oxide aperture. The first and second mirrors are unipolar distributed Bragg reflectors that are n-type (col. 5, lines 1-3). An upper electrode (45) is formed above the second mirror stack and a lower electrode (46) is below the active region. The method of forming the oxide apertures (col. 5, line 57 – col. 6, lines 9) includes oxidizing a portion of the oxide aperture layers and doping each aluminum alloy layer with an n or p-type dopant (col. 5, lines 1-3). Lebby shows all of the elements of the claims except the tunnel junction included in the second mirror and the method of forming it. Brillouet et al. shows (fig. 1) a surface emitting laser comprising an active region (14) sandwiched between a first mirror stack (18 n-type) and a second mirror stack (20 n-type). The second mirror stack includes a tunnel junction for injecting holes into the active region. The tunnel junction includes highly doped n-type and p-type layers (26 and 24), wherein the p-type layer of the tunnel junction is formed adjacent the active region. The laser also includes a lower electrode (22) having an annular aperture (ZC).

The tunnel junction allows the pumping current to be conducted from the top mirror to the active region without a potential drop (col. 5, lines 6-13). The combination of Lebby and Brillouet inherently forms a device in which the tunnel junction is positioned at or near a standing wave null in the optical field because the combined components have the same structure and materials as the applicant's claimed invention. Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the second mirror of the laser described in Lebby by adding tunnel junction layer as taught by Brillouet to allow the pumping current to be conducted to the active region without a substantial potential drop.

(11) Response to Argument

The appellant argues that the invention of Lebby et al. cannot be combined with the invention of Brillouet et al. and thus do not show all of the elements of the claims. Specifically, the appellant argues (1) that the tunnel junction and two n-type mirrors of Brillouet cannot be combined with the VSCEL of Lebby having an n-type and p-type mirror because each invention is different. The appellant also argues (2) that Lebby teaches away from InP/InGaAsP mirrors which Brillouet supposedly requires. The examiner believes that the references can be combined with each other because they are analogous devices that both involve lasers.

In the 103 rejection above, Lebby (fig. 2) is cited as having a first p-type mirror (14), a quantum well (20) including InGaAsN, a second n-type mirror (26), and the laser emitting light at 1300 nm. Lebby is only deficient in showing the first and second mirrors

both being n-type and the tunnel junction included in the second mirror. Brillouet is cited as having a first n-type mirror (18), a quantum well (14) including InGaAs**P**, a second n-type mirror (20), and a tunnel junction (24, 26). Brillouet is only deficient in showing that the quantum well is formed of InGaAsN. Since Brillouet discusses reasons for using the tunnel junction, it makes for a better rejection to use it as a secondary reference. Although it is understood that in the art of lasers, different types of quantum well materials influence the wavelength of the emitted laser light, other references did not cite motivation for using InGaAsN.

(1) Brillouet cures the deficiencies of Lebby by including a tunnel junction in the second n-type mirror and requires that both mirrors are n-type. Brillouet shows in column 3, lines 1-5 that a general object of the invention is to "enable the top mirrors of the lasers to be given high reflectance and low electrical resistance." Therefore the tunnel junction, which is adjacent the top mirror, improves the reflectance and low electrical resistance of that mirror. When the invention is taken as a whole, which includes the two n-type top and bottom mirrors (col. 4, lines 20-63), the invention allows that pumping current to be conducted from the top mirror to the active region without a potential drop (col. 5, lines 6-13). In essence, the improvement of Brillouet is the tunnel junction combined with the two n-type mirrors. In order for the VCSEL of Lebby to work properly with the tunnel junction of Brillouet, the improvement must also include the two n-type top and bottom mirrors. Obviously, any invention works as-is without the use of a secondary reference. However, the addition of a tunnel junction has been taught by Brillouet to improve reflectance of the top mirror. But, in order for the device to operate

properly and receive those improvements, both mirrors must be of the same conductivity type. Therefore Brillouet can be combined with Lebby to achieve the instant invention.

(2) The appellant asserts that Lebby teaches away from InP/InGaAsP mirrors in column 1, lines 43-49 and because Brillouet uses InP/InGaAsP mirrors as stated in col. 4, lines 12-30, the two inventions cannot be combined. The examiner disagrees that the two inventions cannot be combined because Brillouet further goes on to state (col. 6, lines 1-7) that "it is possible to make the mirror by alternating layers of gallium arsenide GaAs and gallium-aluminum arsenide GaAlAs, layers still being of N type, but having a crystal lattice that does not match that of the indium phosphide chip." In essence, Brillouet does not require InP/InGaAsP mirrors as stated by the appellant and further states that the laser still operates if there is a lattice mismatch between the mirrors and the active region. Lebby's invention, having a GaInAsN active region, requires GaAs/GaAlAs mirrors (col. 3, lines 34-47 and col. 4. lines 53-63) and additionally requires that the mirrors lattice match the active material. Since the mirrors of Brillouet may be formed of the same material as the mirrors of Lebby and inherently fulfill the requirements of lattice matching the active region as stated in Lebby, the combination of the references is permissible. Therefore the combined references show all of the elements of the claims.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

MEW
January 22, 2004

Tom Thomas
Supervisory Patent Examiner
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Conferees

Tom Thomas, SPE of AU 2815

Olik Chaudhuri, SPE of AU 2823